

## 1. What is an LCA?



Life-cycle assessment (LCA) is a standardized, scientific method for systematic analysis of flows (e.g., mass and energy) associated with the life cycle of a specific product, technology, service or manufacturing process system. In the case of a product system, the life cycle includes raw materials acquisition, manufacturing, use and end-of-life (EoL) management.

From 1996-2000, LCA guidelines were standardized by the International Organization for Standardization (ISO) ([www.iso.org](http://www.iso.org)) in its 14040 series, and have been used by thousands of companies across a range of sectors to guide product and process improvements. Today, LCAs are increasingly being used to inform public policy; assist in research and development; and aid in decisions surrounding waste management, food versus fuel, biofuels, renewable energy and public policy.



According to ISO 14040/44 standards, an LCA study consists of four phases:

- **Determining scope:** (What you specifically want to study) and system boundaries (what is included and what isn't).
- **Life-cycle inventory:** Data collection of all process inputs and outputs, modeling and analysis.
- **Impact assessment:** Analysis of inputs and outputs using previously developed indicators to arrive at a sense of impact magnitude.
- **Interpretation:** Sensitivity analysis around key variables, comparisons to prior results, etc.

## 2. What is CPA?



The Corrugated Packaging Alliance (CPA, [www.corrugated.org](http://www.corrugated.org)) is a cooperative effort between the American Forest & Paper Association (AF&PA, [www.afandpa.org](http://www.afandpa.org)), Association of Independent Corrugated Converters (AICC, [www.aiccbox.org](http://www.aiccbox.org)), and Fibre Box Association (FBA, [www.fibrebox.org](http://www.fibrebox.org)). Its purpose is to address corrugated material and industry issues, covering containerboard manufacturing through box converting operations, by providing factual information with a coordinated industry focus that effectively acts on industry matters that cannot be addressed by individual members alone.

## 3. What are Five Winds and PE Americas?



Five Winds International ([www.fivewinds.com](http://www.fivewinds.com)) is a management-consulting firm that helps organizations improve the business, environmental and social performance — the sustainability — of their operations, products and services.

PE Americas is a joint venture between PE INTERNATIONAL and Five Winds that is focused on providing sustainability solutions for North American clients. PE INTERNATIONAL ([www.pe-international.com](http://www.pe-international.com)) is the international market leader in strategic consultancy, software solutions and extensive services in the field of sustainability. Serving market leaders around the world, PE has offices in Stuttgart, Vienna, Copenhagen, Manchester, Tokyo, Taipei, Perth, Boston and Kuala Lumpur.

## 4. Why did the CPA conduct the LCA?



Since a total industry study of corrugated products had never been conducted, the CPA had a desire to understand the environmental impact of its products for current benchmarking and to measure improvement with subsequent studies. It would also allow the industry to respond to the increasing number of inquiries from product manufacturers and retailers for information that would allow them to select environmentally preferable packaging options. The study's goal was to generate high-quality, up-to-date information on the environmental impacts of corrugated packaging.

### 5. When will the CPA conduct another LCA?

CPA plans to update the corrugated LCA in 2012.

### 6. What is the carbon footprint of corrugated?



A carbon footprint is a measure of impact on the environment, and in particular climate change. It relates to the amount of greenhouse gases (GHGs) produced through burning fossil fuels for electricity, heating, transportation, etc., so it is primarily related to energy consumption.

The carbon footprint is a measurement of all GHGs produced and is measured in units of tons (or kg) of carbon dioxide equivalents.

The corrugated industry LCA shows that the carbon footprint for production, use and EoL management (cradle-to-cradle life cycle) of a 1 kg U.S. industry-average corrugated product is approximately 1 kg of carbon dioxide equivalents. This value applies to the complete life cycle, so any attempt to use it in comparisons would require comparative data for matched system scope, boundaries and functional unit.



A carbon footprint is a one-dimensional measure of environmental impact with limited usefulness, since it does not reflect resource depletion or comparative functional units. Despite its shortcomings, there is a high degree of interest in carbon footprint among customers and NGOs, and this number is sometimes requested.

### 7. How does the environmental impact of corrugated packaging compare with other types of packaging?



The corrugated LCA did not attempt to compare corrugated with other materials or products. While it's natural to want to make comparisons, it's not simple. Size, manufacturing conditions, application, distance transported, EoL management and many other situation-specific factors affect a product's environmental impact. To compare the results of the corrugated industry's LCA against another product, one would need to first establish comparable functional units for study, system scope, boundaries, etc., and other parameters as defined in ISO 14040 guidelines, including critical review by a panel of experts. While this study did not look at comparative data, its results can be used in future comparative studies. The CPA also may consider a future comparative study.

### 8. How do I specify and purchase corrugated packaging to minimize my environmental impact?



The corrugated industry has a long history of sustainable manufacturing and design. Your corrugated supplier can help you design a package optimized for performance as well as use of fiber and resources. Performance is critical to protect your products in shipping and prevent incremental waste caused by package failure. (Did you know that packaging represents only 3 percent to 15 percent of a product's total environmental impact? The rest comes from the product itself, so protecting it from damage and premature disposal is very important to the planet!) Because more than 80 percent of all corrugated produced in the U.S. is recycled today, it is easy to ensure responsible disposition of the used package. Source reduction has been practiced within the industry for decades as well, engineering high-performance packaging with the least possible amount of fiber material. Furthermore, the forest products industry that supplies fiber for corrugated manufacture is heavily invested in protecting its raw materials resources through the Sustainable Forestry Initiative (SFI). So total environmental impact of corrugated packaging is minimized through the industry's responsible management of the entire life cycle.



### 9. What is the corrugated industry doing to improve its carbon footprint?

Corrugated manufacturers have been working diligently to improve environmental performance for decades. They continually improve their manufacturing operations to increase use of biofuels for energy and decrease use of fossil fuels, and to improve energy efficiency and product performance through better engineering. They have increased corrugated recovery dramatically in the past 20 years so that corrugated is the most-recovered packaging material available today, as well. In addition, in the past 15 years the industry has worked with its customers to reduce the amount of corrugated per unit of U.S. industrial production by 21 percent.



### 10. How can recycling corrugated make a difference?

Old corrugated containers (OCC), recovered for recycling, become important raw materials for the manufacture of new products. The LCA also shows that 42 percent of the global warming potential (GWP) impact from corrugated packaging is caused by the 22 percent of OCC that goes to landfills at EoL. So yes — recycling corrugated makes an important difference and improving OCC recovery is one of the ways in which the corrugated industry can continue to improve its environmental footprint. All that's required is to recover more, since domestic and global markets are hungry for the fiber, which is used in a variety of end products and thereby kept out of landfills. The great news is, every consumer and user of corrugated packaging can help by participating in this effort!



### 11. What is carbon sequestration?

Carbon sequestration is absorption and capture of carbon from the atmosphere. Trees capture carbon out of the atmosphere as long as they are growing, and they store the carbon throughout their life, even after harvest. Burning wood products as fuel releases the same carbon back into the atmosphere that was once captured by the trees, resulting in a net zero carbon impact. Recycling results in no CO<sub>2</sub> releases, since the fiber continues to be used. Composting results in net zero emissions, since CO<sub>2</sub> emitted by aerobic decomposition was originally sequestered. Landfills, on the other hand, result in anaerobic decomposition, which produces methane and carbon monoxide in addition to CO<sub>2</sub>, and can multiply that carbon impact by as much as 20 times.



### 12. How does the corrugated industry LCA account for the environmental impact of forestry operations, and the harvesting of trees?

The energy and other impacts of planting, growing and harvesting of trees is all accounted for in the life-cycle stage of the LCA described as “fiber input to mills.”

### 13. Do 100 percent recycled corrugated boxes have a smaller environmental impact than industry-average boxes or boxes with no recycled content? If so, how much smaller?

This study does not answer that question. This LCA study measured the impact of the average corrugated product and did not measure 100 percent virgin versus 100 percent recycled corrugated material separately, mainly because the data has not been gathered in such a way to make that comparison possible. However, it's important to recognize that any 100 percent recycled paper product is limited because after six to eight uses, the fibers become too short and weakened to reuse. Therefore virgin fiber is always needed to replace the lost or degraded fiber. At present, 20 percent of recovered North American fiber is exported to Asian markets, where it is needed to make packaging for Asian products, because Asia does not have a viable forest products industry to provide its own virgin fiber. Therefore, it is important to recognize that there is a worldwide market that needs both virgin and recycled fiber in order to produce the best possible quality and ensure consistent supply.

